1984

# PLANT DISEASE CONTROL GUIDE FOR PESTICIDE DEALERS

## FUNGICIDE RECOMMENDATIONS FOR CEREALS AND SPECIAL CROPS

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MANITOBA AGRICULTURE

# PLANT DISEASE CONTROL

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Disease losses are serious every year in Manitoba. They result from reduced yield, grade or marketability that occurs at planting, growing, harvesting or storing. An average of 5% loss occurs annually in cereal crops and special crops. In some years when disease incidence is high, disease loss can be up to 100% in individual fields.

A disease can be defined as any process that interferes with the normal growth of a plant. Diseases can be very destructive resulting in death of the plant such as in severe root rot or may result in only slight damage such as an occasional spot.

Plant diseases can be divided into two broad categories:

A) Non-infectious diseases caused by:

1. nutrient deficiencies
2. extremes of temperature, hot or cold
3. excess or deficiency of water
4. deficiencies of soil nutrients
5. mechanical damage

B) Infectious diseases caused by:

1. microscopic organisms such as fungi, bacteria, viruses and nematodes
2. less common causes are mycoplasma like organisms (MLO), slime molds, and parasitic plants. These organisms invade the plant and rob it of nutrients.

Most micro-organisms are beneficial for natural decay. Only relatively few cause plant diseases. Harmful ones can cause serious disease loss. The principal disease causing organism in Manitoba are fungi. Bacteria and viruses cause only a few diseases. Nematodes have not been troublesome in Manitoba except on a few crops such as sugarbeets and greenhouse crops.

The only disease of any consequence in Manitoba suspected to be caused by a mycoplasma like organism (MLO) is aster yellows of barley, wheat, canola, buckwheat, flax, carrots and celery.

Parasitic plants seldom cause disease in crops but can cause severe damage to forest trees eg, dwarf mistletoe of Jackpine and spruce. Dodder is a parasitic plant which is occasionally found attacking flax.

Slime moulds are very rarely encountered as a cause of plant disease eg., slime mould of strawberries.

## DISEASE DEVELOPMENT

Infectious disease results when susceptible plants are invaded by a disease causing organism. This process is directly influenced by weather. The relationship is usually complex involving moisture, temperature, wind and light. Infectious disease organisms such as rust or smut spores are spread by winds. Bacteria are commonly spread by splashing rain. Viruses and MLO are often spread by insects such as aphids and leaf hoppers.

In order for a disease to develop conditions must be suitable for infection and subsequent development of the disease organism. Most fungi and bacteria require free water on the plant surface for spore germination and subsequent infection. This water can come from dew, rain or fog. Cloudy, foggy weather with moderate temperatures favors many leaf diseases. Root rot develops most readily under extremes of wet or dry soils. In both cases plant growth is under stress and the plant is more vulnerable to attack of the disease causing organisms.

## DISEASE CONTROL

Disease control occurs when the life cycle of the pathogen is halted. This occurs when the environment becomes unfavorable for the organism to grow or the plant host is not available for the pathogen to attack.

Disease control can be categorized into several areas. These are:

A) Avoid the disease organism

1. Select a planting site or field not contaminated by the disease causing organism.

2. Use varieties that are resistant to the disease

3. Bury infected crop residue after harvest

4. Practise crop rotation (see table 3)

5. Plant early

6. Harvest at proper time and store crop under ideal storage conditions

B) Exclude the disease organism

Certified seed of a number of crops is inspected for disease and when the amount of disease exceeds tolerance limits the field of seed is not certified. eg. ring rot of potatoes 0 tolerance. Quarantine laws prevent disease spread from country to country or province to province.

C) Eradicate the disease causing organism or its vector

1. Remove diseased plants from fields by roguing eg. potato fields are rogued for virus infected plants.

2. Separate diseased plant part, or parts of the diseased organism from seeds, eg. ergot can be cleaned out of rye seed by a specific gravity seed cleaner.

3. Soil fumigation eliminates disease causing fungi, bacteria and nematodes.

4. Insecticides are used to stop an invasion of vectors (aphids, leaf hoppers) that carry viruses and mycoplasmas.

D) Protect the crop plant from disease

Chemical protection through the use of fungicide and bactericides. Fungicides kill disease causing fungi on seeds such as smut or blight and provide some protection from soil borne fungi that cause seedling decay and blight. Leaves and stems are sprayed to prevent infection by fungi and bacteria causing diseases such as white mold, early blight, bacterial blight and leaf spot.

There are only a few diseases of special crops where fungicides (other than seed treatment) are recommended.

White mold (Sclerotinia) of field beans can be controlled by an application of benomyl (Benlate), Thiophanate methyl (Easout), Chlorothalonil (Bravo) or Iprodione (Rovral) at flowering time. Similarly white mold (Sclerotinia) disease of canola can be controlled by an application of benomyl (Benlate) or Iprodione (Rovral) at blossom time.

Bacterial blight of beans in seed plots can be controlled by several applications of fixed copper fungicide at 7-10 day intervals.

There are many recommendations for fungicide applications on vegetables and potatoes. These recommendations are summarized in table 1. (Fungicides Registered for Disease Control in Potatoes, Special Crops and Vegetables). Seed treatments for cereals and special crops are presented in Table 2.

E) Disease control through crop rotation

Crop rotation, alternating cereal crops with broad leaf special crops will reduce incidence of root rot. Many special crops are subject to the same diseases such as root rot and sclerotinia white mold and thus cannot be grown in the same crop rotation or must be spaced at least three years apart. These include canola, field beans, lentils and sunflowers.

Table 3, gives an indication of the number of years that various crops should be spaced apart in a crop rotation for disease control. A crop rotation is also affected by herbicides that have a residual action. A detailed chart on crop rotation, integrating, disease, herbicide, volunteer crop and fertility considerations has been prepared by the Manitoba Agronomist Committee. It is not available for general distribution but copies are available for examination at the local agricultural offices.

More detailed information on disease control in cereals and special crops is included in the "Field Crop Recommendations for Manitoba".

Vegetable crop disease control recommendations are included in the "Vegetable Crop Production Guide" available from Manitoba Agriculture publications. A pictorial chart illustrating common diseases of special crops and vegetables is also available from Manitoba Agriculture.

## FUNGICIDE APPLICATIONS FOR FIELD CROPS AND POTATOES (OTHER THAN SEED TREATMENT)

### SCLEROTINIA (stem blight, white mold) - Canola (rapeseed)

Use seed from disease free fields. Treat seed to control seed rot, seedling blights and black leg. (See Table 2.) To control soil-borne diseases follow a crop rotation of at least four years. Avoid fababeans, field beans, field peas, lentils, mustard, soybeans and sunflowers in the rotation because of Sclerotinia stem rot. (See Table 2). If necessary, Sclerotinia stem rot may be controlled by aerial application of benomyl (Benlate) 1.0-1.5 kg/ha (0.9-1.4 lb/acre) or Iprodione (Rovral) 1.0-1.5 kg/ha (0.9-1.4 lb/acre) at the 20-30 percent blossom stage. Argentine types are resistant to staghead. Do not sow canola or rapeseed adjacent to canola or rapeseed stubble, and control volunteer seedlings early in the season. For further information see the section Disease Control.

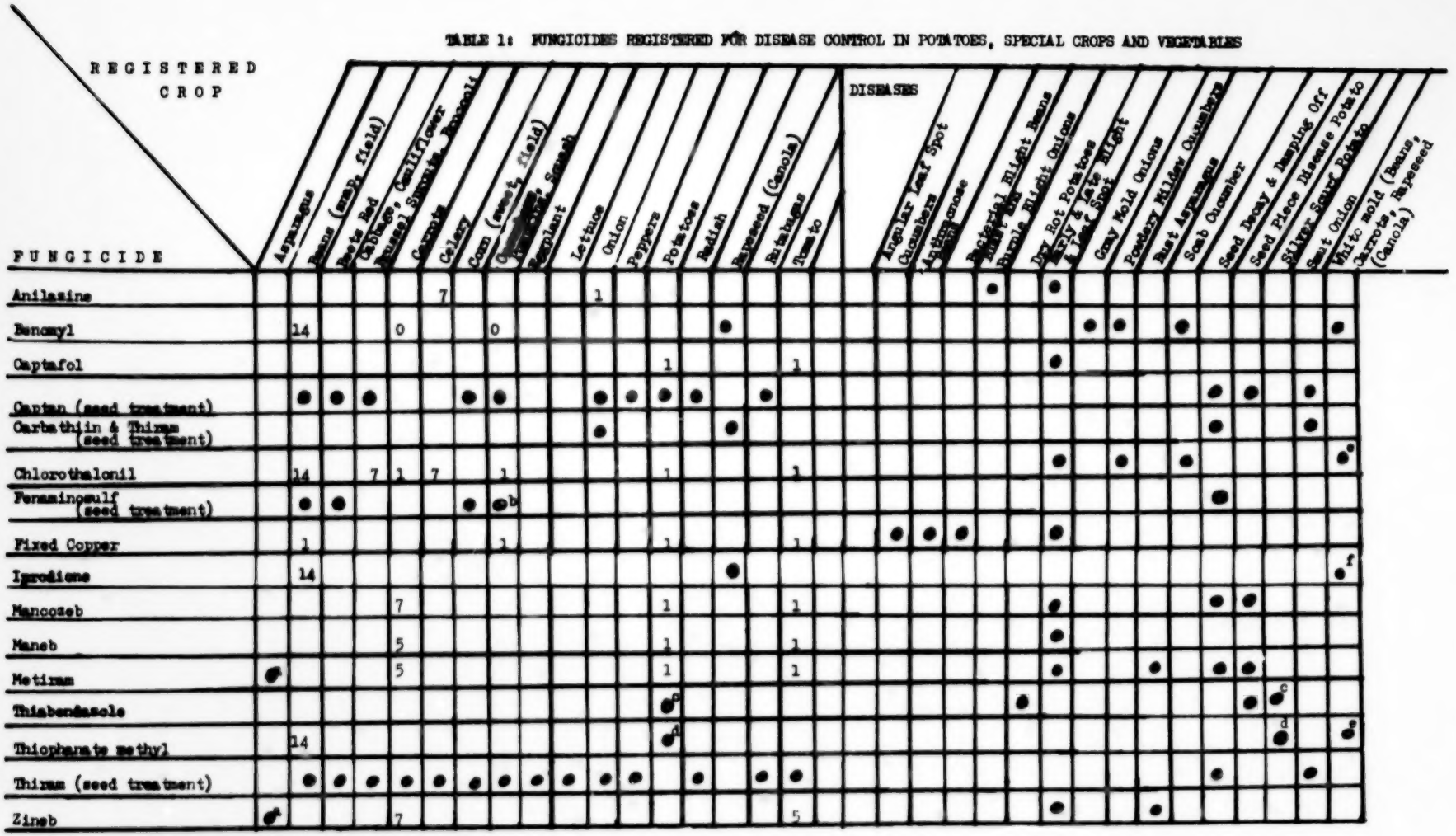
### WHITE MOLD (Sclerotinia), GRAY MOLD (Botrytis) — Field Beans

Avoid fababeans, field peas, lentils, mustard, canola, rapeseed, soybeans and sunflowers in the rotation. Any of the following chemicals may be applied as a protectant treatment: benomyl (Benlate 50WP) at 2.2 kg/ha (2 lb/acre); chlorothalonil (Bravo 75WP) 3.3 kg/ha (3 lb/acre) or Bravo 6F) at 2.2 kg/ha (2 lb/acre); iprodione (Rovral 50WP) at 2 kg/ha (1.8 lb/acre). These fungicides should be applied at specific flowering times and for details of the precise timing of application see the label of the particular chemical. Thorough coverage of blossoms is essential. Do not apply any of these chemicals within 14 days of harvest. Avoid dense foliage favorable for disease development by restricting nitrogen. Follow a crop rotation of four years to control Sclerotinia and other soil-borne diseases.
For further information, see the Disease Control Section and Table 1.

### EARLY BLIGHT — Potatoes

Use of one or more of several fungicides according to directions on the label is recommended. Frequently, these disease control measures are combined with applications of insecticides where the mixture is compatible. Apply one of the following fungicides: maneb (Dithane M-22, Manzate D) at 2.2 kg/ha (2 lb/acre), mancozeb (Dithane M-45, Manzate 200) at 2.2 kg/ha (2 lb acre), metiram (Polyram 80W) at 2.2 kg/ha (2 lb/acre), Difolatan 4.8F at 8.5 L/ha (1½ qt/acre). Bravo 500 at 1.6-2.4 L/ha (24-36 oz/acre) or fixed copper 49 to 55 percent 1.1 to 3.3 kg/ha (1 to 3 lb/acre).

TABLE 1: FUNGICIDES REGISTERED FOR DISEASE CONTROL IN POTATOES, SPECIAL CROPS AND VEGETABLES




a = Do not apply to asparagus spear that are to be cut
b = Cucumbers only
c = Post harvest potato tuber treatment
d = Seed piece treatment
e = Field beans only
f = Canola, field beans and snap beans

NUMBERS INDICATE DAYS BETWEEN LAST SPRAY AND HARVEST
● interval between spray and harvest not applicable
Absence of a number or ● indicates that there is no recommended use

TABLE 2: SEED TREATMENT FUNGICIDES AND INSECTICIDES

| ACTIVE INGREDIENT | TRADE NAME | INSECT: WIREWORMS: Wheat | Oats | Barley | Rye | Flax | INSECT: SEED MAGGOTS: Field Beans | Corn | Soybeans | INSECT: FLEA BEETLES: Canola (Rapeseed) | Mustard | DISEASE: SEED AND SEEDLING ROTS/BLIGHTS: Canola (Rapeseed) | Mustard | Peas | Cereals | Barley | Flax | Rye | Corn | Field Beans | Soybeans | SMUTS CARRIED ON SEED: Corn - Head Smut | Rye-Stem Smut | Wheat-Bunt | Oats-Smut | Barley Covered | Barley-False Loose | SMUTS CARRIED IN SEED: Wheat-Loose Smut | Barley-Loose Smut | BLACK LEG: Canola (Rapeseed) | Mustard | Verticillium Wilt: Alfalfa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INSECTICIDES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| carbofuran (Gr) | Furadan | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | | | |
| FUNGICIDES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| benomyl-thiram (Du) | Benlate T | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | ● | | |
| captan (Du, Wp) | | | | | | | | | | | | | | | | | | | ● | ● | ● | | | | | | | | | | | |
| carbathiin (Sn) | Vitavax solution | | | | | | | | | | | | | | ● | ● | ● | ● | | | | | ● | ● | ● | ● | ● | ● | ● | | | |
| carbathiin-thiram (du) | Vitavax powder | | | | | | | | | | | | | | | | ● | ● | | | ● | | ● | ● | ● | ● | ● | ● | ● | | | |
| (Su) | Vitaflo 280 | | | | | | | | | | | | | | | | ● | ● | ● | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | |
| carbathiin-thiram (Du) | Vitavax powder | | | | | | | | | | | | | | | | ● | ● | | | ● | | ● | ● | ● | ● | ● | ● | ● | | | |
| maneb (Du, Su) | | | | | | | | | | | | | | | ● | ● | ● | ● | | | | | | | ● | ● | ● | ● | | | | |
| mancozeb (Wp) | Dithane M45 | | | | | | | | | | | | | | | ● | | ● | | | | | | | ● | ● | ● | ● | | | | |
| metiram (Du, Su) | Polyram | | | | | | | | | | | | | | | | ● | | | | | | | | ● | ● | ● | ● | | | | |
| thiram (Wp, Su) | Thiram | | | | | | | | | | | ● | ● | ● | | | ● | | | ● | ● | ● | | | | | | | | | | ● |

| ACTIVE INGREDIENT | TRADE NAME | INSECT: WIREWORMS: Wheat | Oats | Barley | Rye | Flax | SEED MAGGOTS: Field Beans | Corn | Soybeans | FLEA BEETLES: Canola (Rapeseed) | Mustard | DISEASE: SEED AND SEEDLING ROTS/BLIGHTS: Canola (Rapeseed) | Mustard | Peas | Cereals | Barley | Flax | Rye | Corn | Field Beans | Soybeans | SMUTS CARRIED ON SEED: Corn - Head Smut | Rye-Stem Smut | Wheat-Bunt | Oats-Smut | Barley-Covered | Barley-False Loose | SMUTS CARRIED IN SEED: Wheat-Loose Smut | Barley-Loose Smut | BLACK LEG: Canola (Rapeseed) | Mustard | Verticillium Wilt: Alfalfa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DUAL PURPOSE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| benomyl-captan, lindane (du) | Gammasan | | | | | | | | | ● | ● | ● | ● | | | | | | | | | | | | | | | | | ● | ● | |
| benomyl-thiram lindane (du) | Thiralin Benolin R | | | | | | | | | ● ● | ● | ● ● | ● | | | | | | | | | | | | | | | | | ● ● | | |
| captan, diazinon (Wp) | | | | | | | ● | ● | ● | | | | | ● | | | | | ● | ● | ● | | | | | | | | | | | |
| captan-lindane (Du) | | | | | | | | | | ● | ● | ● | ● | | | | | | | | | | | | | | | | | | | |
| captan-lindane-diazinon (Du) | | | | | | | ● | ● | ● | | | | | ● | | | | | ● | ● | ● | | | | | | | | | | | |
| carbathiin-lindane (Sn) | | ● | ● | ● | | | | | | | | | | | ● | ● | | | | | | | | ● | ● | ● | ● | ● | ● | | | |
| carbathiin-thiram-lindane (Du, Su) | Vitavax Dual Powder Vitaflo DP | ● ● | ● | ● ● | ● | ● | | | | | | | | | ● ● | ● ● | ● | | | | | | ● | ● ● | ● | ● | ● ● | ● ● | ● ● | ● ● | | | |
| carbathiin-thiram-lindane (Du, Su) | Vitavax RS Du Su | | | | | | | | | ● ● | ● | ● ● | ● | | | | | | | | | | | | | | | | | ● ● | | |
| maneb-lindane (Du) | | ● | ● | ● | ● | | | | | | | | | | ● | ● | ● | | | | | | | ● | ● | ● | ● | | | | | |

FOOTNOTES: Gr - Granules
Du - Dust
Wp - Wettable Powder
Su - Suspension
Sn - Solution

FOOT NOTES TABLE 2

Gr = Granules

Du = Dust

Sn = Solution

Su = Suspension

Wp = Wettable Powder

TABLE 3: CROP — DISEASE RELATIONSHIPS

| DISEASES | CROP | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ALFALFA | BARLEY | BUCKWHEAT | CORN | FABA BEANS | FIELD BEANS | FIELD PEAS | FLAX | LENTILS | MUSTARD | OATS | POTATOES | RAPESEED | RYE | TRITICALE | SOYBEANS | SUGAR BEETS | SUNFLOWERS | SWEET CLOVER | WHEAT | LONGEVITY * |
| Ascochyta Blight | | | | | A | | B | | C | | | | | | | | | | | | 4 |
| Alternaria-Grey Leaf Spot | | | | | | | | | | X | | | X | | | | | | | | 1 |
| Bacterial Blight | | | | | | A | B | | | | | | | | | C | | | | | 1 |
| Cyst Nematode | | | | | | | | | | X | | | X | | | | X | | | | 3 |
| Ergot | | X | | | | | | | | | | | | X | X | | | | | X | 1 |
| Fusarium Wilt & Root Rot | X | | | | X | X | X | X | X | X | | | X | | | X | | X | X | | S |
| Gibberella — Fusarium Head Rot | | X | | X | | | | | | | | | | | | | | | | X | S |
| Helminthosporium — Common Root Rot | | X | | | | | | | | | | | | | | | | | | X | 2 |
| Rhizoctonia Root Rot | X | | X | | X | X | X | X | X | X | | X | X | | | X | X | X | X | | S |
| Sclerotinia | $X^1$ | | | | X | X | X | | X | X | | X | X | | | X | | X | $X^1$ | | 4 |
| Septoria (Cereals) | | X | | | | | | | | | | | | | | | | | | X | 1 |
| Verticillium Wilt | X | | | | | | | | | | | X | | | | | | X | X | | 4 |
| White Rust - Staghead | | | | | | | | | | A | | | B | | | | | | | | 3 |

Diseases with different letters have same name on various crops but are caused by different species or biotypes of the pathogen. This implies that there is little risk of this disease spreading between the indicated crops.

* = longevity of pathogen in soil or on trash in years.

S = pathogen is a soil organism and can survive indefinitely

$X^1$ = uncertain

MAJOR FUNGICIDES USED ON
CEREALS, POTATOES, SPECIAL CROPS AND VEGETABLES

## ANILAZINE

A broad spectrum protective foliar fungicide recommended for control of foliar diseases of vegetables.

Trade name: Dyrene

Registrants: Chemagro Ltd.
Chipman Chemicals Ltd.
Chevron Chemical (Canada) Ltd.,

## BENOMYL

Benomyl is a systemic fungicide for use on snap beans, field beans and canola for control of white mold.

Trade names: Benlate 50 WP
Gammasan + - seed treatment for canola
Thiralin + - seed treatment for canola

Registrants: Chipman Chemicals Ltd.
Chevron Chemical (Canada) Ltd.
DuPont of Canada Ltd.
FMC of Canada Ltd.
Later Chemicals Ltd.,
Plant Products Co, Ltd.
Wilson Laboratories Ltd.

## CAPTAFOL

Captafol is a very long-lasting protective and eradicant contact fungicide for foliar diseases of potatoes and tomatoes. Some persons are allergic or become sensitized to captafol and develop a skin rash. Avoid contact with eyes, skin or clothing.

Trade name: Difolatan

Registrants: Chevron Chemical (Canada) Ltd.

## CAPTAN

Captan is a fungicide used primarily as a seed treatment on special crops and vegetables.

Trade names: Captan
Orthocide

Registrants: Ciba-Geigy Canada Ltd.
Chipman Chemicals Ltd.
Chevron Chemical (Canada)Ltd.
Fisons Corp.
FMC of Canada Ltd.
Interprovincial Co-op Ltd.
Pfizer Co. Ltd.
Stauffer Chemical Corp. of Canada
Uniroyal (1966) Ltd.
Wilson Laboratories Ltd.
Later Chemicals Ltd.
Alberta & Saskatchewan Wheat Pool

CARBATHIIN

Carbathiin is a systemic fungicide effective against various seed borne smuts, blackleg of rapeseed and seedling blights of cereals and special crops. It is applied to the seed at planting time. It is registered for use on wheat, oats, barley, rye, flax, rapeseed, mustard, alfalfa and onions.

Trade names: Vitavax, Vitaflo - seed treatment for cereals, flax, canola, mustard and alfalfa
Pro-Gro - seed treatment for onion smut

Registrants: Uniroyal (1966) Ltd.

CHLOROTHALONIL

A broad spectrum protectant fungicide to control foliar diseases of field beans, vegetables and potatoes.

Trade name: Bravo

Registrants: Chipman Chemicals Ltd.
Diamond Shamrock Canada Ltd.

COPPER (FIXED)

Broad spectrum fungicide and bactericide. Used for controlling foliar diseases caused by fungi and bacteria on sugarbeets, beans, potatoes and some vegetables. Copper compounds are also used as algicides and wood preservatives.

Trade names: Kocide
Tri-cop
Kocide 101
Basi-Cop
C.O.C.S.
Coppercide

Registrants: Ciba-Geigy Canada Ltd.
FMC of Canada Ltd.
Later Chemicals Ltd.
Pfizers Co. Ltd.
Stauffer Chemical Corp. of Canada Ltd.
Kocide Chemicals Co. Chemical Corp.
Chipman Chemicals Ltd.

FENAMINOSULF

A very persistant fungicide for use on seed of beans beets, celery and corn. It controls seed decay. A mixture of fenaminosulf and quintozene is registered as a seed treatment for damping off of sugarbeets.

Trade names: Lesan (formerly Dexon)
Dexon

Registrants: Chemagro Ltd.

IPRODIONE

A broad spectrum contact fungicide. Active against fungi of the following genera: Botrytis, Sclerotinia, Alternaria, Helminthosporium, Rhizoctonia and some Fusarium spp. Registered for control of sclerotinia disease affecting canola, field beans and snap beans. It is also registered for control of fruit rot of strawberries.

Trade name: Rovral 50 WP

Registrant: May & Baker Canada Ltd.

MANCOZEB

Mancozeb is a contact fungicide with protective action for use in controlling fungus leaf diseases of vegetables and potatoes. It is also registered for control of covered smut and false loose smut of barley, smut of oats, bunt of wheat, seedling blight and seed rot of flax. Mancozeb has a similar activity to maneb and zineb.

Trade names: Manzate 200
Dithane M-45

Registrants: DuPont of Canada Ltd.
Interprovincial Co-ops Ltd.
Rohm and Haas Co. of Canada Ltd.
Wilson Laboratories Ltd.
Kroeker Seeds Ltd.

MANEB

Maneb is a general purpose broad spectrum fungicide used to control potato and vegetable foliar diseases. It has a protectant and an eradicant action. It is registered as seed treatment for control of covered and false loose smut of barley, bunt of wheat and smuts and seedling blight of oats.

Trade names: Maneb
Manzate D
Dithane M22
Mantox

Registrants: Ciba-Geigy Canada Ltd.
Chipman Chemicals Ltd.
FMC of Canada Ltd.
Wilson Laboratories
Alberta & Saskatchewan Wheat Pool
Interprovincial Co-ops Ltd.
Pfizers Co. Ltd.
Rohm and Haas Co. of Canada Ltd.
DuPont of Canada Ltd.

METIRAM

A protectant action fungicide for foliar diseases of potatoes and vegetables, and as a seed treatment for covered and false loose smut of barley, bunt of wheat, oat smut, seed rot and seedling blight of flax. It is also used as a potato seed piece treatment.

Trade name: Polyram

Registrants: FMC of Canada Ltd.

THIABENDAZOLE

A broad spectrum preventative curative fungicide with activity similar to benomyl and thiophanate methyl. Registered for use on potatoes as a post harvest (pre storage) application for control of storage diseases. Also registered for control of leaf spot of sugar beets.

Trade names: Mertect

Registrants: Merck Ag-Vet

THIOPHANATE-METHYL

Thiophanate-methyl is a broad spectrum preventative curative systemic fungicide closely related to benomyl and thiabendazole. It is used as a seed piece treatment for potatoes and a foliar spray for beans for control of white mold and grey mold.

Trade names: Easout
NF-44
Topsin M

Registrants: Ciba-Geigy Canada Ltd.

THIRAM

A broad spectrum protective action fungicide. Thiram is mainly used as a seed treatment for cereals, special crops and vegetables. All alfalfa seed prior to sale must be treated with Thiram for control of seed borne Verticillium wilt.

Trade names: Thiram
Arasan

Registrants: Uniroyal (1966) Ltd.
Pfizer Co. Ltd.
Chipman Chemicals Ltd.
Plant Products Co. Ltd.
Stauffer Chemical Co. of Canada Ltd.

## ZINEB

Zineb is a general broad spectrum fungicide for use in controlling foliar diseases of vegetables and potatoes.

Trade names: Zineb
Dithane Z78
Parzate Z
Thiogreen

Registrants: Ciba-Geigy Canada Ltd.
Chipman Chemicals Ltd.
FMC of Canada Ltd.
Interprovincial Co-ops.
Later Chemicals Ltd.

# FUNGICIDE INDEX

| CHEMICAL | TRADE NAMES |
|---|---|
| anilazine | Dyrene |
| benomyl | Benlate, Gammasan +, Thiralin + |
| captafol | Difolatan |
| captan | Captan, Orthocide |
| carbathiin | Vitaflo, Vitavax, Pro-Gro |
| chlorothalonil | Bravo |
| copper (fixed) | Kocide, Tri-cop, Kocide 101, Basi-cop, C.O.C.S., Coppercide |
| fenaminosulf | Lesan, Dexon |
| iprodione | Rovral |
| mancozeb | Manzate 200, Dithane M-45 |
| maneb | Maneb, Manzate D, Dithane M-22, Mantox |
| metiram | Polyram |
| thiabendazole | Mertect |
| thiophanate-methyl | Easout, NF-44, Topsin M |
| thiram | Thiram, Arasan |
| zineb | Zineb, Dithane Z-78, Parzate Z, Thiogreen |

## NAME AND ADDRESS OF REGISTRANTS

Alberta Wheat Pool
Wheat Pool Bldg.
505-2 St. S.W.
CALGARY, Alberta
T2P 1N8

Chemagro Ltd.
Box 295
BIRDS HILL, Manitoba
ROE 0H0

Cehvron Chemical (Canada) Ltd.
3228 South Service Road
BULRINGTON, Ontario
L7N 3H8

Du Pont of Canada Ltd.
#109-1035 Beaverhill Blvd.
WINNIPEG, Manitoba
R2J 3R2

FMC of Canada Ltd.
1274 Plains Road E.
BURLINGTON, Ontario
L7S 1W6

Kocide Chemical Corp
12701 Almeda Road
HOUSTON, Texas
U.S.A. 77045

Later Chemicals Ltd.
12080 Horseshoe Way
RICHMOND, British Columbia
V7A 4V5

Pfizer Co. Ltd.
404 N. Front St.
SARNIA, Ontario
N7T 2S9

Chipman Inc.
400 Jones Road
P.O. Box 9100
STONEY CREEK, Ontario
L8G 3Z1

Ciba-Geigy Canada Ltd.
6860 Century Ave
MISSISSAUGA, Ontario
L5N 2W5

Diamond Shamrock Canada Ltd.
150 Consumers Rd.
WILLOWDALE, Ontario
M2J 1P9

Fisons Corp
80 Melford Dr.
SCARBOROUGH, Ontario
M1B 2G3

Interprovincial Co-op Ltd.
P.O. Box 1050
SASKATOON, Saskatchewan
S7K 3M9

Kroeker Seeds Ltd.
286 S. Railway Ave.
P.O. Box 415
WINKLER, Manitoba
ROG 2X0

MSD Ag-Vet
Division of Merck Frosst Canada Inc.
P.O. Box 1005
POINTE CLAIRE, Quebec
H9R 4P8

Plant Product Co. Ltd.
314 Orenda Rd.
BRAMALEA, Ontario
L6T 1G1

Rohm and Haas Co. of Canada Ltd.
830 King Edward
WINNIPEG, Manitoba
R3H OP5

Uniroyal (1966) Ltd.
Chemical Div.
Erb St.
ELMIRA, Ontario
N2B 3A3

Stauffer Chemical Co. of Canada Ltd.
369 Gilford Ave.
WINNIPEG, Manitoba
R3J 2J6

Wilson Chemical
605 Avila Ave.
WINNIPEG, Manitoba
R3T 3A5

This list is not a complete list of registrants but only indicates companies whose product is known to be available in Manitoba.

## SEED TREATMENTS

| CHEMICAL | FORMULATION | PRODUCT NAME | REGISTRANT[1] |
|---|---|---|---|
| Benomyl, thiram | Wp | Benlate T Benomyl - Thiram fungicide seed dressing | DUQ |
| Benomyl, thiram, lindane | Du | Thiralin-Plus | NCR |
| | Du | Ipco Benolin-R Insecticide/ Fungicide dust | INT |
| Captan | Su | Chipman Flowable Seed Treatment | CHP |
| | Wp | Captan 75 Seed Protectant | STF |
| | Su | Captan SP-4 Flowable | STF |
| Captan, lindane | Du | Drillbox Lindasan Seed Treatment | CGC |
| | Du | Alberta Pool Rapeseed and Mustard Seed Treatment | ALW |
| | Du | Chipman Gammasan Drill Box Seed Treatment | CHP |
| Captan, lindane, diazinon | Du | Agrox D-L Plus Insecticide/ Fungicide Drill and Seed Treatment Powder | CHP |
| | Du | Pickseed D-L-C Seed Box Treatment | OTT |
| | Du | Drillbox Diazinon-Lindane plus captan seed treatment powder | CGC |
| | Du | DCL Slurry | CGC |
| | Du | Co-op Rapeseed and Mustard Seed Treatment | INT |
| | Du | Co-op D-L & C Drill Box Seed Treatment | INT |
| | Wp | Chipman B-5 Dual Purpose Seed Treatment | CHP |
| Carbathiin | Sn | Vitavax Solution Seed Protectant | JNR |
| Carbathiin, lindane | Sn | Vitavax dual solution | UNR |
| Carbathiin, thiram | Du | Vitavax powder | UNR |
| Captan, diazinon | Wp | Chipman Agrox 1.F Dual Purpose Seed Treatment | CHP |

| CHEMICAL | FORMULATION | PRODUCT NAME | REGISTRANT[1] |
|---|---|---|---|
| Carbathiin, thiram, lindane | Du | Vitavax RS Powder | UNR |
| | Su | Vitavax RS Powder | UNR |
| | Du | Vitavax Dual Powder Seed Protectant | UNR |
| | Su | Vitaflo DP | UNR |
| Maneb | Wp | Agrox NM Drill Box Seed Treatment Powder | CHP |
| | Su | Agrox Flowable Seed Treatment Fungicide | CHP |
| | Du | Alberta Pool N-M Drill Box Seed Treatment | ALW |
| | Du | Pool Seed Treat Powder | SAW |
| | Wp | Manzate D Agr. Fung. | DUQ |
| | Du | Co-op NM Drill Box Seed Treatment | INT |
| Maneb, lindane | Du | Pool NM Dual Purpose Drill Box Seed Treatment Powder | ALW |
| | Su | Mergamma Flowable Dual Purpose Seed Treatment | CHP |
| | Du | Pool Dual Purpose Seed Treatment | SAW |
| | Du | Mergamma NM Drill Box Dual Purpose Seed Treatment | CHP |
| | Du | Co-op NM Dual Purpose Seed Treatment | INT |
| Mancozeb | Wp | Dithane M-45 Seed Protectant | ROH |
| | Wp | Manzate 200 Mancozeb Fungicide | DUQ |
| Metiram | Wp | Polyram & Dust (Metiram) | BAZ |
| | Su | Polyram-Fungicide Seed Protectant | NCR |
| Thiram | Su | Gustafson 42-S Thiram Fungicide | GUS |
| | Wp | Thiram 75 Wp Wettable Powder Fungicide | UNR |
| | Su | Thiram 320 Flowable Fungicide | UNR |
| | Wp | Thiram 75-Wp | NCR |
| | Wp | Pfizer Thiram 75 Seed Fungicide Du | PFF |

[1] Registrants

| | |
|---|---|
| ALW | Alberta Wheat Pool |
| BAZ | BASF Canada Ltd |
| CGC | Ciba-Geigy |
| CHP | Chipman |
| DUQ | Dupont of Canada Limited |
| GUS | Gustafson Inc. (Hartwick Sales and Service, London Ontario) |
| INT | Interprovincial Co-ops Ltd. |
| NCR | Niagara Chemical Division |
| OTT | Otto Pick & Sons Seeds Ltd. |
| PFF | Pfizer |
| ROH | Rohm and Haas Company |
| SAW | Saskatchewan Wheat Pool |
| STF | Stauffer |
| UNR | Uniroyal |

POOR

QUALITY

ORIGINAL